Deep Space Test Bed
Grounding Plan

Objectives

The primary objective of this document is to inform potential users of the grounding plan for NASA's Deep Space Test Bed Facility. The grounding plan is presented such that an experimenter will be familiar with the grounding architecture being offered by the facility and also what information needs to be communicated from the experimenter to the facility operators.

Applicable Documents and References

NASA-HDBK-4001 Electrical Grounding Architecture for Unmanned Spacecraft

SAE ARP1870 Aerospace Systems Electrical Bonding and Grounding for Electromagnetic Compatibility and Safety

HW OTT, "Noise Reduction Techniques in Electronic Systems", Wiley

Deep Space Test Bed SDC Specification and User's Manual

Acronyms and Definitions

C-GND	Central chassis ground point, bonded to gondola frame
CHASSIS RET	Return path to chassis ground
DSTB	Deep Space Test Bed
DECK PLATE	Plate to which an experiment is mounted
E-GND	Earth or building safety ground
EMI	Electromagnetic interference
FCDS	Flight Control and Data System – Central computer system responsible for experiment data storage and communications with NSBF equipment
GCC	Ground Control Center – operations control center during flight
GND	Equipotential point that servers as a reference potential for an electrical system
GSE	Ground Support Equipment – equipment used on ground to control and power experiments
HV	High voltage – voltages such that $\|V\| > 50V$
NASA	National Aeronautics and Space Administration
NSBF	National Scientific Balloon Facility
PDS	Power Distribution System – Electronic system that provides voltage conditioning from the gondola solar arrays to the primary bus voltage
RET	+28V Return – current return path for primary bus voltages

SDC	Smart Data Connector - Embedded computer system that acts as interface between experiment electronics and the FCDS
V	Volts

General System Description

The objective of the grounding architecture is to provide for personnel safety while minimizing undesired interactions (ground loops or EMI) between different experiments or between experiments and the DSTB systems. The Smart Data Connector (SDC) will be the communications interface between an experiment and other DSTB systems. Communications between the experiment and the SDC may have an isolated or non-isolated ground depending on requirements described in the Experiment Grounding Options. Communications between the SDC and the DSTB FCDS will be through an isolated network interface. Each experiment will be provided a +28V primary current return (RET) to the power system and a CHASSIS RET. RET and CHASSIS RET will connect at a single point (C-GND) at or near the solar array power distribution system. No RET currents should flow in the CHASSIS RET path. For safety C-GND will be connected to earth or building ground (E-GND) whenever possible during preflight operations. See Figure "Experiment Grounding".

Experiment Grounding Options

Each experiment will be provided a +28V and RET connection. Also provided will be a CHASSIS RET point for connection of chassis safety & shielding grounds. An experiment will be responsible for conversion of the +28V primary voltage to their required secondary voltages. No primary or secondary return voltages are allowed to flow in the CHASSIS RET. For grounding purposes an experiment will either be classified as having an isolated or non-isolated secondary and as having an isolated or non-isolated chassis as described below. Experiments should inform DSTB facility personnel of their grounding layout and attempt to conform to a one of the suggested plans below.

Isolated Experiment Secondary Voltage

Experiments with isolated (floating) secondary voltages should connect their secondary voltage ground to RET with a minimum 1 Meg ohm bleed resistor. No return currents should flow through CHASSIS RET. If isolation is maintained through the serial port interface to the SDC then jumper S1 of the SDC should be installed. It is encouraged that experiments in this classification use the differential RS422 electrical interface to the SDC serial ports.

Non-isolated Experiment Secondary Voltage

Experiments whose secondary voltage ground is directly connected to the +28V primary RET have an option of isolated or non-isolated communication with the SDC. When a ground connection is used (RS232, J2/J3 pin 5) jumper S1 of the SDC should be removed to prevent ground loops. When an ungrounded connection is used (RS422 or RS232 floating) jumper S1 should be installed.

Isolated Experiment Chassis

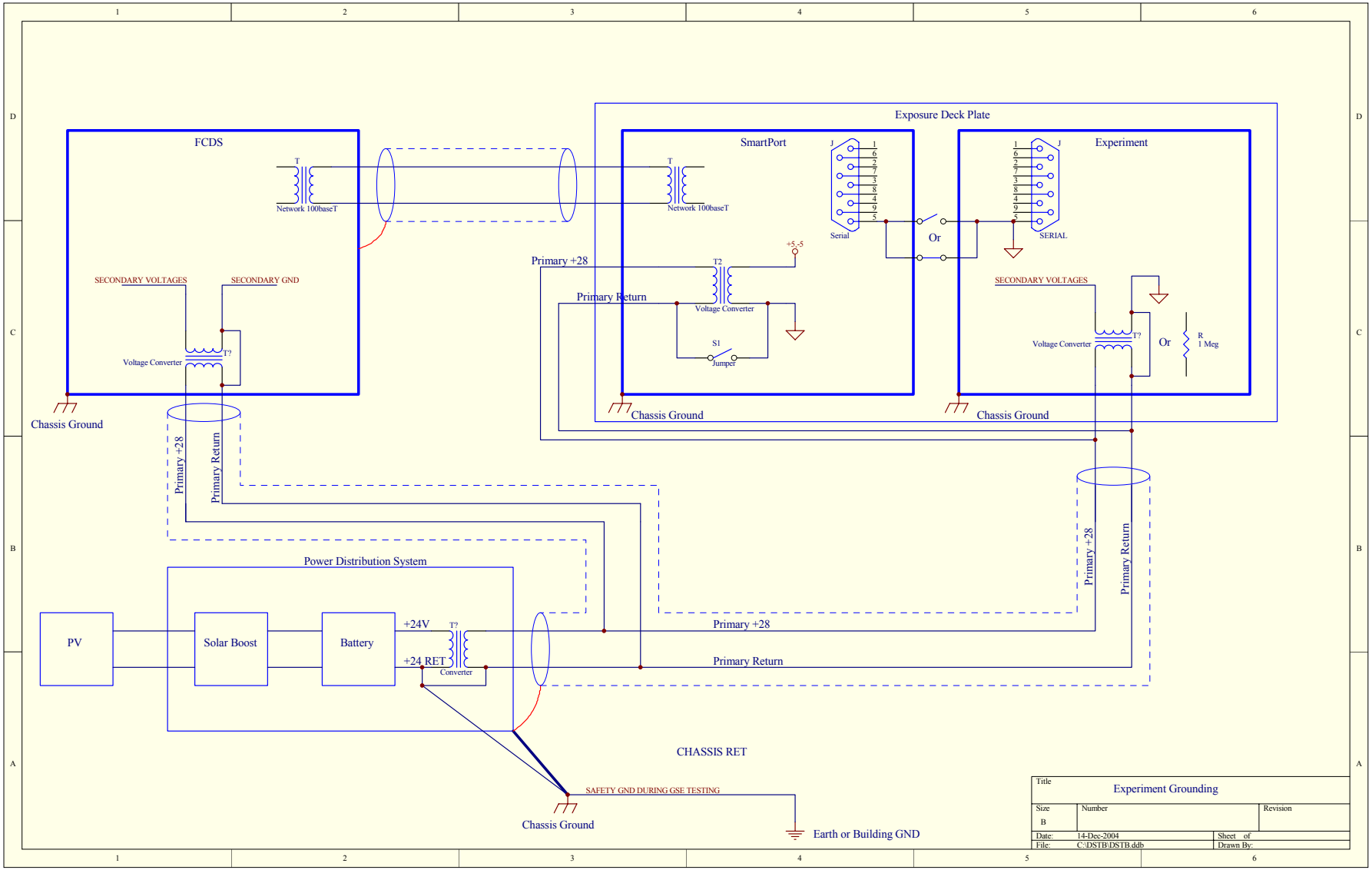
For experiments whose chassis ground is separate from their primary or secondary voltage ground the chassis ground may be connected to a provided chassis grounding point (CHASSIS RET). An isolation of 1 Meg Ohm or greater is acceptable. No primary or secondary currents should flow through CHASSIS RET.

Non-isolated Experiment Chassis

Experiments whose chassis ground is common with their primary or secondary voltage grounds or whose isolation is < 1 Meg Ohm will be electrically isolated from the DSTB structure to prevent primary or secondary currents from flowing through CHASSIS RET. Experiments with a non-isolated experiment chassis should notify DSTB facility personnel so that proper isolation can be provided.

Experiments Using High Voltage

Experiments using HV such that $|V| > 50V$ are encouraged to have an isolated experiment chassis and should verify that their chassis is properly grounded to CHASSIS RET. Experiments with HV should notify DSTB facility personnel of the voltages and currents used in their experiments.


Exposure Deck Plate
FCDS
SmartPort
Experiment
Network 100baseT
Network 100baseT
Serial
SERIAL
Or
SECONDARY VOLTAGES
SECONDARY GND
Voltage Converter
T?
Primary +28
Primary Return
T2
+5-5
Voltage Converter
S1
Jumper
SECONDARY VOLTAGES
Voltage Converter
T?
Or
R
1 Meg
Chassis Ground
Chassis Ground
Chassis Ground
Primary +28
Primary Return
Primary +28
Primary Return
Power Distribution System
PV
Solar Boost
Battery
+24V
+24 RET
T?
Converter
Primary +28
Primary Return
CHASSIS RET
SAFETY GND DURING GSE TESTING
Chassis Ground
Earth or Building GND
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